

Systems Thinking based Design intervention for Supporting Healthy Ageing / Ageing in Place

Working Paper

John Darzentas

Professor

Department of Product and System Design Engineering, University of the Aegean, Greece

and

Leverhulme Visiting Professor

Department of Computer Science, University of York, UK

Helen Petrie

Professor of Human Computer Interaction,

Human Computer Interaction Research Group, Department of Computer Science, University of York, UK

Jenny Darzentas

Marie Skłodowska Curie Research Fellow,

Human Computer Interaction Research Group, Department of Computer Science, University of York, UK

Abstract

This paper presents an approach based on Systems Thinking to create design interventions, demonstrating its use and potential usefulness in the case of providing support for Healthy Ageing. It attempts to clarify and enforce some important steps in Systems Thinking based Design methods. These primarily include the capturing, learning about and understanding such complex problem spaces leading to description of a 'Holon' presenting a holistic view of the design problem space; the translation of this Holon into Systems Language; and the role of Service Design in the proposed approach.

The paradigm of Service Design used within the Systems Thinking Design process provides a platform for demonstrating its use in designing complex problem spaces such as the case of Healthy Ageing.

The particular problem space is about caring for older people in order to provide support for Ageing in Place i.e. staying at home and maintaining a degree of independence.

Introduction

The use of Systems Thinking as the core of an approach to create design interventions is the theme of this paper. The thesis is that to tackle complex human centric design problems designers need tools to be able to deal with this complexity and diversity by capturing understanding and learning about the whole situation of concern. Systems Thinking seems to be a natural platform on which an approach to tackling these design problem spaces can be formed.

This paper introduces such an approach by first briefly supporting the thesis that Systems Thinking is a natural ally to tackle these complex design problems and then by describing the approach emphasising the importance of the capturing of a 'Holon' and its translation to System Thinking Language. Then after introducing the emerging domain of Service Design it presents a view of its potential to be catalytic to the process of design within and for complex problems.

The next section introduces such a complex design problem space, that of 'ageing in place' which is used as an example to demonstrate the proposed approach. A brief description of the proposed approach follows, including the role of Service Design. The proposed approach is briefly demonstrated via the 'Healthy Ageing' exemplar, followed by the Conclusions.

A complex design problem space: The Concept of "Healthy Ageing".

The problem space is that of older people and their needs. It is set within the context that seeks potential design interventions, which is tending toward the use of technology to complement or even replace carers in providing assistance. There is much debate around what are the services (tasks, procedures) that are needed and desired, as well as the acceptability of technology by older people and their families and care structures.

To try to give some flesh to the concept of healthy ageing, we turn to the themes identified in a European project¹ that ran from 2003-2007. Their working definition was that Healthy ageing is the process of optimising opportunities for physical, social and mental health to enable older people to take an active part in society without discrimination and to enjoy an independent and good quality of life. The project concentrated on 10 issues contingent to older populations, and looked at Retirement and pre-retirement; Social capital; Environment (where older people would be living, including change and extremes of heat and cold); Mental Health; Nutrition; Physical Activity; Injury Prevention; Substance Abuse (alcohol, nicotine); Use of Medication and associated problems (noting that as an age group, older people are the largest users of medication); and Preventive Health Services (health literacy).

¹ http://ec.europa.eu/health/archive/ph_projects/2003/action1/docs/2003_1_26_sum_en.pdf (European Commission 2005)

Another often used concept is that of Ageing-in-Place. This can be seen as part of Healthy Ageing. More specifically, it refers to the ability to live in one's own home and community safely, independently, and comfortably, regardless of age, income, or ability level. The term is quite old. For instance, Lawton noted (1982):

“A crucial component of successful ageing is maintaining one’s independence. One way to achieve this independence is for older adults, persons aged 65 or older, to age in place”
(Lawton, 1982)

Ageing in place is a process that involves both the person and the environment; it is a continuous dynamic interaction as both the person and the environment change

In approaching this complex design space, there are some learning curves that revolve around two main questions. Firstly, who are the stakeholders and the interested parties, and secondly where is the onus, (especially with current focus on technology and its capabilities).

For the first, it is important to understand the notion of carer as being multi-dimensional. Carers may be informal carers, who are for instance family members, informal in the sense of not having training. Carers may be people with no familial relationship, people who are paid to ‘care’ and provide services and some companionship, as well as people who by their proximity (for instance long term neighbours) ‘keep an eye on’ things, and may expect reciprocal concern. Carers may of course be formal carers, with training, and employed by social services to provide support in activities of daily living. These activities, known as ADLs, (Katz, 1983) have been formally described and are used by medical and social services to understand how capable someone is of living on their own. These are just some of the nuances that go into the term ‘carers’.

For the second, the onus on technology has come to be so well known that it is accepted by policy makers and others. Concern with increasing numbers of older people, and fewer resources to provide government sponsored care, new ways of providing care must be found, and developing supporting technologies seems to be a good solution.

For older people, - and for all of us -, these concerns of adequate care, and the nature of care in the days to come bring anxieties that relate to existential matters, such as fear. That might be fear of loss of control, (over one’s life and way of living), fear of loss of personal dignity, and fear that one will simply cease to matter and become burden on family and state.

It is against this background, and with these concepts acting as short-hand for complex situations, that the subject of this paper is positioned.

An approach to designing within complex design problem spaces

From among the community of designers and design researchers working in the area of relating Systems Thinking to Design, (Darzentas & Darzentas, 2014, 2016; Jonas, 2014; Jones, 2014; Riis, 2013; Liem, 2012; Nelson & Stolterman, 2012; Norman, 2009; Sevaldson, 2011, 2017), they recognize that the need to include and

- acknowledge complexity
- value participative approaches
- look at the whole problem space
- utilise emergence

Outside of that particular community (Blizzard & Klotz, 2012; Charnley et al, 2011; Monat & Gannon, 2015; Sargut & McGrath, 2011; Valtonen, 2010) there are some common understandings, as well as acknowledgement of the potential of Systems Thinking in the tradition of Soft Systems Thinking, (Checkland, 1981, 1988, 2000; Jackson, Flood and Jackson, 2003).

What appears to be needed is more complete ways (approaches, methodologies) which utilise all the relevant knowledge and experience coming from the use of Systems Thinking approaches in other domains, mainly Management, and integrate them in the methods/methodologies of design interventions.

The structuring of the design approaches around Systems Thinking will offer, initially, the same benefits to complex human centric design problem spaces that it offers to tackling, for instance, management problems namely the capturing learning and understanding about the design problem space. After that it is for the design world to adopt and enhance its usefulness to design.

Here we attempt to introduce an approach which could evolve into a methodological suggestion, and which is based on two basic positions, set out below as a. and b.:

a. **Ways / methods of Capturing and Translating the Holons to Systems** are very important especially in the case of very large and very complex design problem spaces. For capturing and translating a Holon of a design space an array of Design Methods that can be used to provide content and structure to that Holon include:

- Participative Methods: Workshops, Focus Groups, Interviews...
- Ethnographic methods: Observing, Shadowing and Probes...
- Survey Methods: Online Questionnaire...
- Literature Research...

Translating to Systems Thinking domain language (notions, principles, etc.) provides the opportunity to use their “power” to understand the behavioural and structural properties of the Design Problem Space now expressed as a System.

b. **Products are by-products of Service Design** The paradigm of Service Design (Manzini, 2009, 2014, Meroni & Sangiorgi, 2011) can be used within the Systems Thinking Design approach to provide a platform for aiding the tackling of such design problem spaces. Its importance is posited here using the paradigm of Product-Service Systems (PSS) (Morelli et al, 2016, Tukker et al, 2004) . This is considered to be an influential model in the designing of services. It is a model of designing services that characterises the design intervention by considering the product with the service and using both for adding value to the end result.

However, we claim that products should be considered as by-products-of Service Design (Darzentas et al, 2016). This is because:

- the complexity which very usefully characterises the services to be designed is 'damaged' by the assumptions that products associated with those services pre-exist, and are not emerging as part of the design process.
- capturing as much as possible of the design problem space obviously provides a more robust description of it. Imposing a major constraint on the problem space such as the retaining of the product(s) and assuming that, by default, the product is associated to the service, as in the case of PSS's (e.g. servitising) does exactly the 'damage' mentioned above to the manufacturers, the customers and more generally, the stakeholders.

Hence a main hypothesis here is that the product(s) should be emergent 'by-products' of the service design process. An example to illustrate the by-product hypothesis is the following: Take the case of designing means and ways to provide access to cash or to other banking services.

- The design of an accessible cash card for people who are blind (Product Design).
- The design of a number of accessible bank services based on the existing accessible cash card usable by people who are blind (PSS).
- The design of accessible bank services for customers who are blind. In this case by-product(s) might emerge. These by-products might be an advanced card design and/or other accessible means of using the banking services.

The Design Problem Space of 'Healthy Ageing' through the steps of the proposed approach

To express a Holon one way is to 'see' as much as possible of the problem space and co-create participatively, descriptions of it. Rich Pictures (Checkland, 1981, 1988) is still a popular approach to represent complex human centred problem spaces. Other approaches such Giga Mapping (Sevaldson, 2011) could be used to capture a Holon of the situation of concern. For instance, for the concept of "Healthy Ageing" the following Rich Picture has evolved as a Holon.

Fig.1 below demonstrates its use and potential usefulness in the case of providing support for Healthy Ageing.

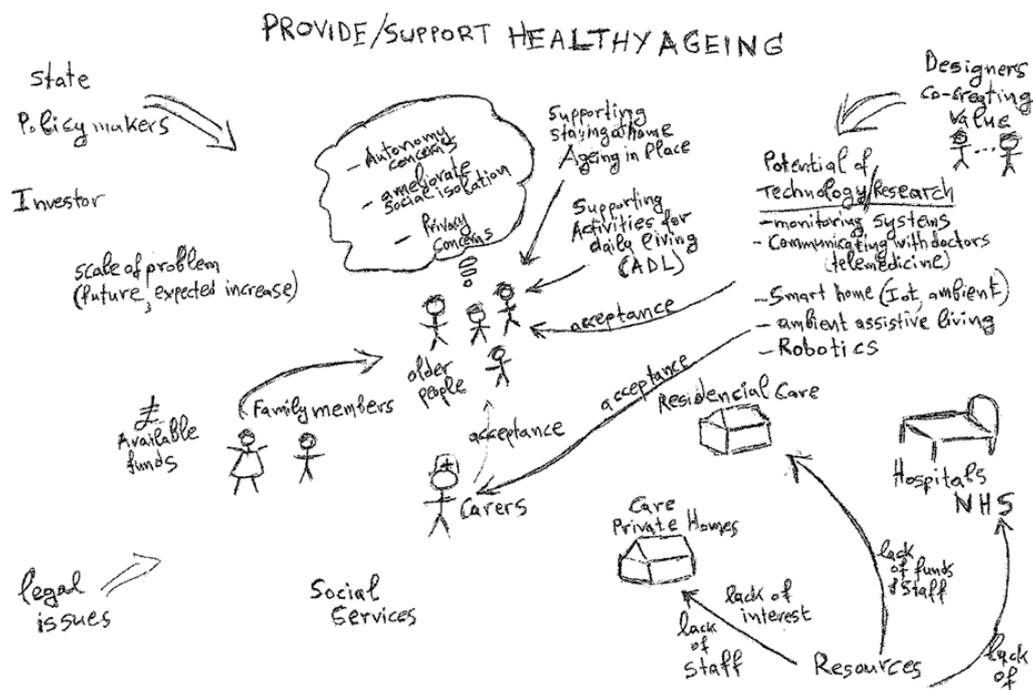


Fig. 1: A Holon capturing the problem space of the 'Healthy Ageing', 'Ageing in Place'

The participative and co-design characteristics of any Systems based design approach imply that any convergence to a Holon requires a number of iterations. The 'translation' of that Holon to Systems Thinking language has been proposed and achieved in several ways in the literature (Checkland, 1988; Jackson, 2003). Once there is a translation then the Systems Thinking theoretical and practical frameworks take over leading towards interventions.

A Holon, translated into Systems Thinking language, builds mainly on the basis of the following components:

- Elements (or parts) (often the most obvious part of a system)
- Interconnections (often the flow of information)
- Functions (functions are the behaviours expected from elements and interconnections) typically the least understood, and the ones that affect a system profoundly

It is also characterized by:

- Purpose
- Boundary
- Environment
- Subsystems
- Hierarchical structure

This 'translation' to Systems Thinking language offers access to the tools of thinking for learning and understanding about the problem space. These tools contain useful notions and tenets such as:

- Complexity
- Emergent properties

- Variety (requisite variety)
- Self-reference
- Autopoiesis
- 2nd Order Cybernetics
- Resilience
- Attractors

A main position here is that once there is a System Thinking view of the design space formed then the next steps of the approach are to identify emerging services to be designed. Then the design methods and approaches from the substantial array available can be further applied to examine which products can be designed to support these services. Nevertheless, it is posited that the designing of the identified emerging services within the design space precedes and 'reveals' the directions that products (if necessary) should be designed to help to deal with the design problem space.

In the case of Healthy Ageing a product could have the form of an artifact containing prescription medicine with instructions. A PSS alternative could be the enhancement of the artifact with basic intelligence to remind and guide the user on how to use it. The design of a service to cover the needs of the user in terms of mobility, vision, etc. could be, apart from human assistance, complemented by technology, based for instance, on the use of robots.

Further, in the case of technology-driven services, using robots in 'Healthy Ageing' scenarios raises questions as to how desirable it is to have an application or a robotic agent to remind an older person to take medicine, or to have a robot bring a tablet computer to an older person, so they can use it to order groceries. Perhaps these scenarios are driven more by the abilities of the technology in terms of internet connections and mobility, than real needs. Support may start with the services identified by Healthy Ageing scenarios, e.g. help with lifting, with reaching, with sorting. Then the next step would be to find the 'products' to support those identified services (and these products can be technologies, people or combinations.)

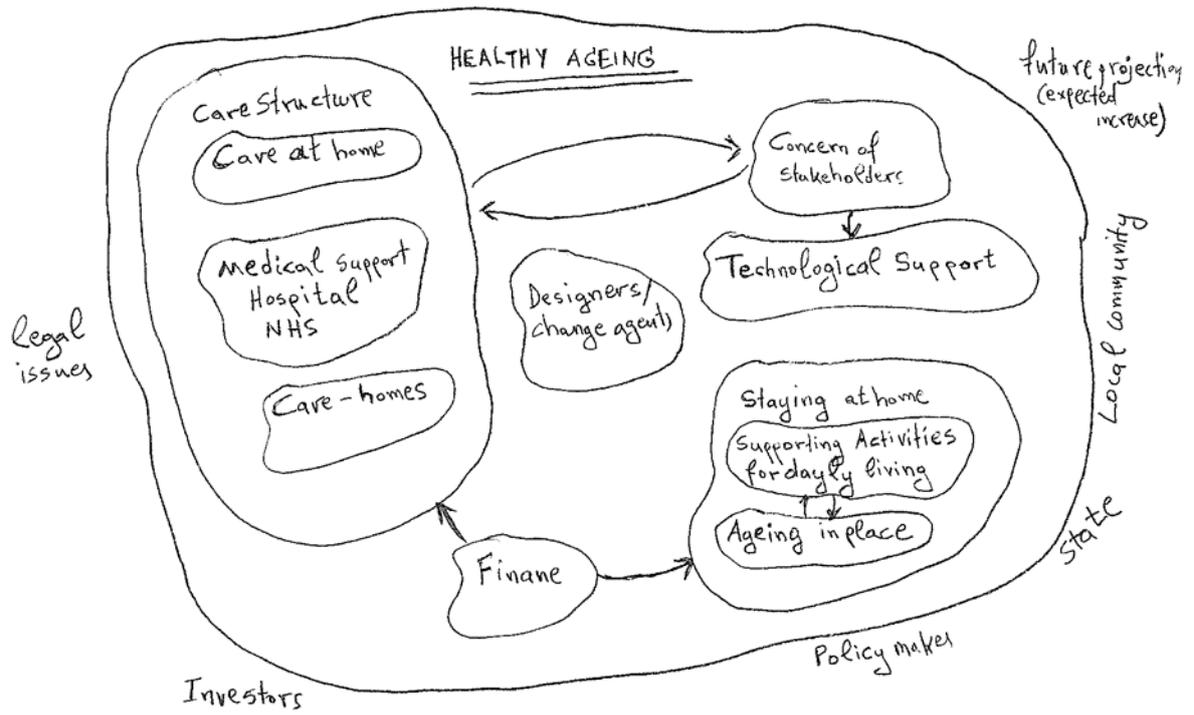


Fig.2: A 'translation' of the Holon into Systems Thinking language

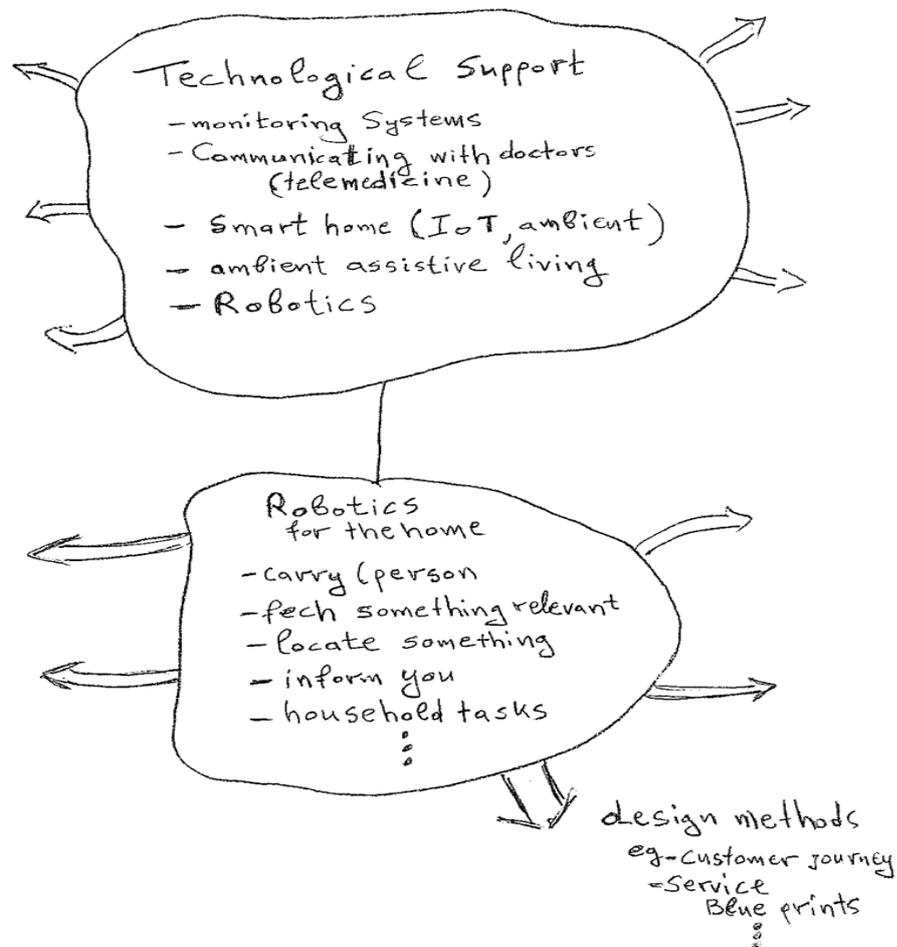


Fig.3: Reaching hierarchically to the subsystems relating to technological support. A possible departure point for Service Design interventions.

Conclusions

This paper tries to show a number of features that we claim can be attributed to Systemic Design. It tries to show how systemic design can be used to inspire the design of services and accommodate large holistic overviews. It notes that systemic design can offer principles and tenets that can be used to guide and inspire research. In addition, Systemic Design allows for value co-creation; aids sharing of perspectives and values; and allows for new perspectives to be created

The paper describes briefly a Systems Thinking based design approach which also utilises the notion of Service Design. It is demonstrated via the designing of services for 'Healthy Ageing'. Following this thinking, and learning about the problem to lead to a possible intervention, does not mean that the design of services to be implemented should be based on solely the capabilities of technological support, rather they should take a service approach, and then use whatever technological product, for instance robots, that can best deliver the specified services.

References

- Blizzard, J.L & Klotz, L.E. (2012) A framework for sustainable whole systems design *Design Studies* 33(5), 456-479
- Charnley, F., Lemon, M. & Evan, S. (2011) Exploring the process of whole system design *Design Studies* 32 (2), 156-179
- Checkland, P. (1981) *Systems Thinking, Systems Practice*, Wiley
- Checkland, P. (1988). The Case for 'Holon', Guest Editorial, *Systems Practice*, 1(3), 235-238.
- Checkland, P. (2000) Soft Systems Methodology: A Thirty Year Retrospective *Systems Research and Behavioral Science*, 17, 11–58
- Darzentas, J. & Darzentas, J.S. (2016) Product-Service Systems or Service Design 'By-Products'? A Systems Thinking Approach *Proceedings of the Design Research Society Conference 2016*, <http://www.drs2016.org/506/>
- Darzentas, J & Darzentas, J.S. (2014) Systems Thinking for Service Design: a natural partnership *Proceedings of Relating Systems to Design Symposium (RSD3)* <https://systemic-design.net/rsd3-proceedings/>
- European Commission DG SANCO, DG ECFIN and DG EMPL (2007) Healthy ageing: keystone for a sustainable Europe: EU health policy in the context of demographic change Discussion paper
- Flood, R. & Jackson, M. (1999) *Creative Problem Solving: Total Systems Intervention* Wiley
- Jackson, M. (2003) *Systems Thinking: Creative Holism for Managers* Wiley
- Jonas, W. (2014) The strengths / limits of Systems Thinking denote the strengths / limits of Practice-Based Design Research *FORMAkademisk* 7(4)
- Jones, P. (2014). Systemic design principles for complex social systems. In G. Metcalf (ed.), *Social Systems and Design, Translational Systems Science Series*, Vol 1, pp 91-128. Springer Japan.
- Katz, S. (1983) Assessing Self-maintenance: Activities of Daily Living, Mobility, and Instrumental Activities of Daily Living *Journal of the American Geriatrics Society*, 31, (12), 721–727
- Lawton, M.P. (1982) Competence, environmental press, and the adaptation of older people. In: Lawton MP, Windley PG, Byerts TO, editors. *Aging and the environment: Theoretical approaches*. New York: Springer; 1982. pp. 33–59
- Liem, A. (2012) Teaching strategic and systems design to facilitate collaboration and learning, *FORMadademisk*, 5(1), 29-48
- Manzini, E. (2009) New Design Knowledge, (Viewpoint article) *Design Studies* 30, 4-12
- Manzini, E. (2014) Making Things Happen: Social Innovation and Design *Design Issues* 30(1) p.57-66
- Meroni, A. & Sangiorgi, D. (2011). *Design for Services*, Farnham, Gower

Monat, J.P. & Gannon, T. F. (2015). What is Systems Thinking? A Review of Selected Literature Plus Recommendations *American Journal of Systems Science*, 4(1): 11-26 DOI: 10.5923/j.ajss.20150401.02

Morelli, N. & de Götze, A.(2016) Revisiting PSS and Service Design in the Light of SD- Logic *Proceedings of Fifth Service Design and Innovation conference (ServDes 2016)* pp 119-131

Nelson, H.G. & Stolterman, E. (2012). *The design way: Intentional change in an unpredictable world*. Second edition. Cambridge, MA: MIT Press.

Norman, D.A. (2009). The way I see it: Systems Thinking: a product is more than the product. *Interactions* 16, 5 (September 2009), 52-54. DOI: <https://doi.org/10.1145/1572626.1572637>

Riis, K. (2013) A systems theory perspective on the relationship between practice and research in the making disciplines *FORMakademisk* 6(2) Art.7 1-13

Sargut, G. & McGrath R G. (2011) Learning to Live with Complexity *Harvard Business Review* 89 (9), 68-76

Sevaldson, B. (2011). 'GIGA-Mapping: Visualisation for complexity and Systems Thinking in design'. In *Proceedings of Nordic Design Research (NORDES 2011)*. Retrieved from <http://ocs.sfu.ca/nordes/index.php/nordes/2011/paper/view/409/256>

Sevaldson, B. (2017). 'Redesigning Systems Thinking'. *FORMadademisk* Vol 10, No 1.

Tukker, A. (2004) Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet *Business strategy and the environment* 13 (4), 246-260

Valtonen, A. (2010) Is systemic design the next big thing for the design profession? *Proceedings of design Research Society Conference 2010* retrieved January 2014 from <http://www.designresearchsociety.org/docs-procs/DRS2010/PDF/121.pdf>